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National Science Teachers Association

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The Effectiveness of Science Teaching

A Forum by the AAAS Co-operative Committee on the Teaching of Science and Mathematics

DR. K. LARK-HOROVITZ

Purdue University

Chairman of the Committee

THE Cooperative Committee on the Teaching of Science and Mathematics of the American Association for the Advancement of Science was created in 1941 by representatives of several scientific societies to work on educational problems the solution of which can be attained better by cooperative action than by any single scientific group working alone.

In February of 1947 the President's Scientific Research Board requested that the A.A.A.S. Cooperative Committee aid in estimating the effectiveness of the training of scientists in this country.

As a result of this request a report on "The Present Effectiveness of Our Schools in the Training of Scientists" has been prepared and appears as Appendix II (pp. 47-149) of Volume four of "Science and Public Policy," a report to the President by The President's Scientific Research Board.[1]

The Forum[2] based on the findings of the above report was held in Chicago at the time of the 1947 meeting of the AAAS.

1 Available from the Superintendent of Documents, Washington, D. C. at 35c per copy.

2 A recording, two double sixteen inch 33 1/3 R.P.M. discs, is available on a loan basis. Arrangements for the use of the recording should be made with the Chairman of the Committee, Dr. K. Lark-Horovitz, Department of Physics, Purdue University, Lafayette, Indiana.

Why the Report on the Effectiveness of Science Teaching was Needed

PHILIP N. POWERS

(Formerly a staff member of the President's Scientific Research Board, now advisor on Scientific Personell, Atomic Energy Commission, Washington, D. C.)

IT IS OF course necessary for me to remark that I am speaking as an individual and not as a representative of any government agency, neither the White House where I was formerly employed, nor the Atomic Energy Commission where I am presently employed.

The question assigned to me almost answers itself. Scientific research requires scientists. This is always true, but today there is a serious shortage of this particular manpower resource, as there is of so many of our important resources. The shortage of highly trained scientists is probably the chief bottleneck to scientific progress today. The only place where this bottleneck can be broken is in our schools—grade schools, high schools, colleges and universities. No report on scientific research in the country could therefore be complete without considering "The Present Effectiveness of our Schools in the Training of Scientists."

We would like for scientists to come up with more answers on the common cold, on diseases of old age, on increasing the supply of food for a growing and hungry world and

on many other problems. Radioisotopes give us a spectacular new tool for studying these problems. Heralding this new atomic age, we now have these isotopes in abundance, but we do not have the scientists with the training to use them.

This is but one bottleneck. There are many others. The question that needs to be answered is, "What is the prospect for getting the scientists needed?" How well are we doing in training a new group of young scientists to take over these jobs?

THE REPORT which the President asked his Assistant, Dr. Steelman, to prepare covers a broad assignment relating to scientific research in this country, both Federal and non-Federal. The size of the assignment and the variety of the material studied is at least suggested by the length of the report—999 pages. Of these, the particular appendix that we are discussing tonight accounts for an even 100 pages.

The breadth of the assignment to the Assistant to the President can perhaps be made more clear by briefing a part of the Executive Order. The President asked him to serve as chairman of the President's Scientific Research Board and in this capacity to review all Federal research to determine (1) the fields of work, (2) the personnel required, (3) what part is done outside of government, and (4) the cost of all this research. He was also asked to review non-Federal research—its nature and scope, the personnel required, and its cost. In addition he was specifically requested to review "the facilities for training new scientists."

ON THE BASIS of all this information, the Assistant to the President was asked to make recommendations for the Federal program—for improving its efficiency, planning and coordinating it, administering it and getting the necessary people.

Accompanying the Executive Order was a "Statement by the President", the last paragraph of which was, "I am concerned over the current shortage of scientific personnel and ask for a careful inquiry into this phase of the research program."

All of this boils down to a request by the President for a report on the overall status of American science, but with particular attention to the proper role of Federal research. The Board itself was a cabinet-level group, representing the agencies with major research and development programs. It was set up to assist and advise its Chairman.

To prepare such a report, it was clearly necessary to find out just how serious the shortage of scientists actually is, and to examine the underlying reasons for it. It was necessary to look closely at present trends to get some estimate of how quickly we may be able to get under way on some of the important scientific work that we cannot do at present.

It was necessary to find out how the scientists that we have are being used. Are there, for example, too few scientists engaged in the training of more scientists or in basic research?

THIS IS A very fundamental question, for it relates to short and long-range objectives of our society. We have always emphasized applied science in this country. In addition, we now emphasize military applications. We threw nearly everything we had into the war and in so doing neglected basic research and teaching. Are we still going too far in that direction? Are we still risking the quality of the future of science in order to make weapons and gadgets today?

Certainly we are taking some risks. We must do so to some extent. But how serious are the risks? Have we backed up enough from our war-time policy of depleting scientific manpower resources and our store of fundamental knowledge? Can we go right ahead and expand our Federal and industrially supported science, even if, in so doing, the expansion is at the expense of science teaching in the colleges and universities? In this competition for scientific personnel, are the incentives for working in government and industrial research laboratories too much greater than the incentives for teaching?

These are important questions. Let there be no mistake about that. The future strength and vigor of American science are at stake. The progress that we are going to make on the peaceful applications is at stake. If we go too far in emphasizing short-range objectives

at the expense of long-range ones, that is, at the expense of training top-notch scientists, then we risk the leadership which we may urgently want ten or twenty years from now.

THESE questions are as difficult as they are important. But one way to get some evidence on them is to check on the effectiveness with which we as a nation are presently achieving results (1) in applied research and development, (2) in basic research, and (3) in the training of new scientists. The staff of the President's Scientific Research Board sought answers to each of these questions. Tonight we are concerned with the third one on the training of scientists. Answers to this question were sought in several ways. Chief of these methods was, however, the request to the American Association for the Advancement of Science.

The best way to find out about the effectiveness of science teaching is to ask the scientists themselves. They were asked in several ways, but in this instance the President's Scientific Research Board turned to the American Association for the Advancement of Science as the most representative organization of scientists and asked them to give us the answer. Through the President of the Association, the request was passed on to its Cooperative Committee on the Teaching of Science and Mathematics. Their report was prepared and was then used by the President's Scientific Research Board in formulating some of the basic recommendations which appear in its report "'Science and Public Policy."

Science in Elementary and Secondary Education

MORRIS MEISTER

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THERE have been several appraisals of science teaching in recent years—all of them good and most of them useful. The unique circumstance about the appraisal which concerns us this evening is that the President's Advisors were driven to make this evaluation by the dangerous lack of Manpower for Research. Evidently, Public Policy in an Atomic Age is tied to Science and Technology. Here, as in most things, it is men that count. And we do not have enough of them for the job that lies ahead. Because we were profligate with science talent during the war, a generation of scientists was lost. Any effort to make good the shortage and improve the quantity and quality of competent men forces an examination into what science we are teaching, how we are teaching it, and how many are being taught.

This appraisal is notable in another respect. While ostensibly the President's Advisors are concerned with maintaining a full and steady flow of able scientists, they recognize the importance of a public that is literate in science. Unless the later is true, the people will not support the plans and the recommendations of men of science. The Report to the President seeks a program of science education for all—a program which is as mindful of general education as it is of science education for the specialist.

But, what does the appraisal reveal about our present program? Instead of a twelve year science sequence, beginning in Grade One, relatively few children receive any organized science instruction until Grade Seven. In the earlier grades science teaching is, in many places, incidental. Sometimes it appears as part of the reading program and sometimes as the lesser adjunct in a social studies unit. Well trained elementary school teachers of science are few. Courses of study and textbooks show the kind of wide variation which is characteristic of an early stage of development. Equipment is either non-existent or inadequate. Teaching procedures are not well designed. There is an almost total absence of concern about locating, stimulating and providing guidance for children with potential talent in science. The only encouraging sign is a widespread and heightened interest in this field.

WHAT IS THE situation in secondary schools? First and foremost is an overcrowded curriculum, in which science is hardly represented to a degree in keeping with the needs of our times. All available data indicate that the percentage of high-school pupils enrolled in science courses has been declining. The typical pupil takes two science courses during four years of work; one in general science and one in biology. The contribution which physical science can make to his education is not provided beyond the elementary concepts treated in general science. A small number take the course in physics or chemistry at the eleventh or twelfth grade level; but the courses seem to be poorly designed for purposes of general education. Since such courses are offered to heterogeneous groups, the work often fails to serve the needs of the talented pupils in these groups. High schools rarely offer training in science beyond the initial courses in biology, chemistry or physics. Very little attention is paid to the experimental methods of science or to the development of scientific habits and attitudes. Little use is made of the history of science with its adventure and dramatic action, so appealing to the interests of young people.

Another disturbing factor in the science teaching picture is the serious lack of competent teachers. It is worse in science than in other subjects. Good science teachers are being attracted by the larger salaries and easier working conditions in industry in business and in government. There has been a decided decrease in men teachers. The teaching load of the science teacher is often discouragingly greater than that of other subjects. Frequently, the science teacher must teach, in addition, one and even two subjects not related to science. In too many instances, science teachers report inadequate teaching materials and the special facilities required for good science teaching. Under conditions such as these, it is no wonder that high school science teaching is less than effective in realizing either the objective of general education or of stimulating and nurturing the potential scientist. At a time when the future of the Nation and of civilization itself depends upon better training in science, it is disquieting in extreme to find so little being done in secondary schools to identify and guide science-talented youth toward careers in science.

This, in brief is the essential indictment made by the Report to the President on science teaching in our schools. What, then, are the indicated solutions to the problem—the recommendations?

BASIC TO any improvement in the teaching of science for the purposes that are the concern of the President's Advisors, is a well-conceived machinery for the early identification and guidance of science-talented youth. Such machinery can operate informally in the elementary grades. A number of elementary schools have been experimenting with some very promising methods of stimulation and selection. In the ninth and tenth grades, special techniques for identifying special aptitudes can be employed. Here, one cannot over-emphasize the selective value of Science Clubs, Science Fairs and Science Congresses. These activities, when carefully planned, are the media in which science talent thrives. They are frequently the triggers which release dormant interests and abilities in young people. For many, they add the kind of purpose to school work which overcomes obstacles and contributes to sound growth and development.

In conjunction with these activities, schools can make better use of a steadily increasing variety of good aptitude tests in science, and of vocational interest inventories. The personal data thus obtained for each pupil can become part of the record of school progress which accompanies him from grade to grade. The program of guidance in the school can start with this record and include individual conferences, follow-up procedures, and the like. The guidance counselor and the science teacher are closely associated in the process of identifying science talent.

At least three general procedures are suggested by the Report, for dealing with the needs of science talented pupils. For the very small high school, only the generalized science courses are feasible; but the teacher can develop special projects, reports and teacher assistance for those able and interested in science. Science Club activities are especially

valuable in this connection. Sometimes, correspondence courses in certain science fields have served a good purpose.

In the larger schools, the pupils gifted in science can be scheduled for "Major-work" or "Honors" classes under competent science teachers. In other subjects, they join with classmates from varied curricula.

A THIRD procedure, possible in the larger school systems, is to organize one or more specialized high schools. Any city large enough to support five high schools can profitably designate one of them as a High School of Science. Under this arrangement, an organized program of selection can be carried out. Excellent results have been obtained in practice by basing the selection of students upon a written test, a study of previous school record, the recommendations of the lower school authorities and, in some instances, a personal interview. The written test consists of carefully assembled CAVD material, refined over a period of years, so that the test becomes a valid and reliable instrument for selecting ninth graders who do unusually well with a curriculum oriented in science and mathematics.

In the six annual Westinghouse Talent Searches, students from two such High Schools of Science have repeatedly been selected for honors, in numbers out of proportion to their school populations. One of these schools, with a register of about 2,000, has had from one to four "winners" in each of the six annual competitions. The curriculum of a High School of Science includes 4 to 5 years of science study and laboratory work, 3 to 4 years of mathematics, 4 years of English, 4 years of social studies, 3 years of one foreign language, together with the usual requirements in art, music and health education. Such a curriculum does not lack in elements of general education and is quite in line with college entrance requirements.

A SECOND recommendation of the Report stresses the importance of a carefully planned program of science instruction for all pupils. This program must articulate the work in high school with that in the elementary school and must aim at the steady development of understanding of important science concepts. In essence, this recommendation will achieve a higher degree of scientific literacy among the citizens of a democracy. The recommendation also carries with it the implication that three years of science be required of all high school students. A strong plea is made for a year of physical science (rather than physics or chemistry) to follow the courses in general science and biology. For the science-talented students, four to five years of science are recommended. Here, courses in biology, physics and chemistry can serve a real need. Often such students can profit from an advanced course in physics, chemistry, or biology.

Another recommendation stresses the importance of adequate laboratory facilities, equipment and supplies. The Report recognizes the unique educational contributions of teacher and pupil demonstrations; but emphasizes the importance of individual laboratory experimentation. For the science talented pupil, the laboratory is the place where he learns "to put questions to nature" and where he can obtain answers to problems by the methods of science. Such laboratory work shifts the focus of activity from passive observation to active participation; it develops skill in coordination and manipulation. Individual laboratory work is a golden opportunity for developing resourcefulness in the use of physical materials and instruments of measurement.

Recognizing the shortage of highly competent science teachers, the Report urges an improved system of in-service training, teacher workshops, counselling service and supervision. To quote from Raleigh Schorling's Bill of Rights for Teachers, "Every teacher has the right to an adequate amount of helpful and constructive supervision". To this "Right" can well be added the Right to teach classes that are not too large, the Right to have time in school for planning, the Right to a 45-hour week, the Right to have good materials and enough of them, the Right to work in a room that can be made pleasant and appropriate to the tasks to be learned, and the Right to adequate compensation.

THE CAPSTONE recommendation of the Report concerns itself with a National

Commission on the Teaching of Science and Mathematics. This Commission should be given the wherewithal for conducting certain essential studies, so that answers to very vexing problems can be obtained. A complete appraisal of science and mathematics teaching in secondary schools should be made. More carefully planned teaching materials, for both pupils and teachers, must be developed. Studies should be made of various curricular and administrative arrangements employed in small and large communities to meet the needs of talented youth. Guidance procedures for identifying science talent should be further developed. What are the most effective ways to use demonstrations, laboratory work, projects, shopwork, field excursions, and audio-visual aids? What are the important science concepts basic to effective citizenship in a democracy, in this atomic age? What is the most effective age and grade placement of these concepts in the curriculum?

These are fundamental questions. They can be answered only through intensive investigation and study. The present crisis in science teaching can be relieved if means are provided for conducting such investigations and studies.

The Effectiveness of the Teaching of the Physical Sciences

LLOYD W. TAYLOR

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THE SERVICE which the Cooperative Committee was asked to provide to the President's Scientific Research Board was quite in line with the committee's previous activity. One of the earlier reports included a passage with which I may appropriately begin my present remarks.

"The end of World War II has confronted American education with two highly disturbing facts. The first fact is that the survival of modern civilization depends upon understanding and control of scientific techniques whose power for good and evil dazes human imagination. The second fact is that our teachers and our equipment for teaching this understanding and control are woefully inadequate.

"Science teaching, particularly at the high school level where the ordinary citizen finishes his formal education, is not ready in America for the responsibility which it must nevertheless assume. Nor is education ready in other subject areas for its obligations in an atomic age. The time is short. The task is nothing less than to lift a whole generation of American citizens to a level of knowledge and human goodness which has hitherto been attained by only a small fraction of our people."

(end quote)

THE magnitude of this objective, coupled as it is with the virtual certainty of catastrophe if it is not attained, is positively frightening. And it is not made any less so by the question which immediately occurs: "Why limit the program to 'a whole generation of *American* citizens'?" Indeed if we do so limit it shall we not jeopardize the whole undertaking? If two world wars in one generation have taught us anything it is that one powerful nation, if unscrupulous, anti-social and committed to international brigandage, can frustrate the peaceful intentions of all the rest of the world. The ideal then, however unattainable it may seem to be, would be to include all the major powers in such an educational program along with as many of the smaller nations as could be persuaded to go along.

Stated in this way the problem appears almost hopeless. Possibly it is, but let us not be too precipitate about reaching such a conclusion. Perhaps there is some encouragement in the fact that it seems reasonably possible to get general recognition of the existence of such a problem. Certainly the irreducible minimum condition for dealing with it will be our own recognition of it and our courageous attack on it.

If we classify mathematics with the physical sciences, as was done in the President's report, we come face to face with the fact that the teaching of mathematics in primary and secondary schools has been so inept that

almost the entire population is negatively conditioned to arithmetic and still more so to mathematics in general.

EVEN IN THE experimental sciences our record as teachers has not been all that we sometimes like to think. So poor has been our scientific exposition that the proverbial man on the street expects scientific miracles with almost as much undiscriminating confidence as that with which savages expect miracles of their medicine men. One can even detect traces of affected pride in such expressions as "Of course I could never expect to understand that."

The twentieth century variety of lack of scientific comprehension, rooted in a defensive lack of curiosity, is so widespread as to be very disquieting. All the sciences, and particularly the physical sciences, are increasingly dependent on mathematics. And yet the typical layman's mental processes become paralyzed the minute a mathematical symbol appears on the scene. This bodes ill indeed for the general comprehension of science that must constitute the principal reservoir of support to which scientific progress of the future must look in a democracy.

Though the President's report did not concern itself primarily with the problem of stimulating a general comprehension of the nature of science among laymen, that problem was so pervasive that it cropped up irrepressibly at many points in the report. It turned out, indeed, that this was one quarter in which we teachers of science have met all but complete defeat up to the present. We knew before the war that in training scientists (as distinct from teaching science to the layman) we were doing a good job. The war merely showed that in that restricted field we were doing even better than we had thought.

But on the longer range undertaking of insuring the future of science by a broad policy of science in general education we have made very little headway. The corresponding professional inertia among artists was overcome long ago and art education for the layman is a major activity. In the field of music it is only within the last generation or so that the corresponding development has occurred. The dividends were immediate and overwhelming, as anyone in touch with college or community musical organizations knows.

A SIMILIAR awakening among teachers of the physical sciences is long overdue. The ground is being broken at the secondary level by science clubs and science talent searches such as that of Westinghouse. But science in elementary schools lags, and the general courses in the various sciences at the college level have not begun to catch the spirit of universal education. This is primarily because college and university teachers are primarily subject matter specialists and only secondarily educators. This condition will continue until there is a radical change in the type of graduate training received by prospective college teachers.

In a democratic system, such problems as those now facing science education cannot be dealt with by administrative fiat. Only an informed and aroused public can provide the necessary support. The required information must reach the public primarily through professional scientists. The day when men of science can safely confine their activities to narrowly professional pursuits has passed. Having long tried the experiment of leaving the exposition of elementary science to ill-trained teachers and to the Sunday supplements, we find that the attempt has in large measure failed, and this in spite of some truly remarkable work on the part of some of the outstanding science editors. But unless men of science themselves do far more of this kind of work than they have in the past, the western democracies will presently find themselves at the mercy of those accustomed to solve such problems by dictatorial procedure as the price of survival!

There is one measure that many universities, especially the larger research centers, can take that might speed up considerably both the volume of research and rate of production of trained scientists. There is scarcely a research center which does not have an accumulation of temporarily or permanently discarded apparatus, some of which could be used to advantage by smaller institutions. A system of apparatus loans, at first by direct negotiation but ultimately through some central clearing agency established for the purpose, would be highly advantageous. Indeed

it should be one of the measures to be undertaken in the interest of good public relations of science.

Perhaps such a loan program could be made even more effective by sending along with the apparatus some Masters-degree candidates. Our big-name universities are swamped. It would be to the interest of everybody concerned if they could concentrate on upper-level candidates for the doctorate in science, enlisting well qualified colleges and smaller universities (there are many such) in the lower-level graduate work, under their supervision. Many problems would arise in the administration of any such plan, but they would be as nothing compared with the problems that will rise out of failure to improve every opportunity for the vigorous prosecution of science education on every front.

NEEDLESS to say every inducement should be offered to promising young scientists to prepare themselves adequately for effective careers. The President's report recommends a series of scholarships and fellowships far beyond anything in existence at present outside of the educational features of the G. I. Bill. For the details of these and other proposals to the same end you should consult the original report.

In conclusion society now faces a crisis by reason of a vast increase in the demand for scientific services at the higher levels, simultaneously with a sharp diminution of the supply of trained scientists. This can be attributed in general to the war itself, but may be more specifically identified as primarily a consequence of a suicidal policy of induction procedure. That policy could well have cost us the scientific leadership of the world, which in these days means the political and economic leadership. Even as it is, the United States has been grievously wounded. To heal those wounds expeditiously will require all the resources that we can summon, public and private. Under democratic procedure only an informed and aroused electorate can authorize the necessary measures. Whether the required education of the public can be effected in time to enable it to preserve its own cultural integrity may be a question. Earlier cultures have disintegrated under less threatening conditions than now exist. Our only chance lies in prompt, far-sighted, vigorous and sustained effort on the part of those who are aware of the crisis and are in a position to guide our natural and human resources to avert it. The time is short and the chance is long. But we have no choice.

Science in Education*

Science in Education was the theme of one of the sessions of the recent meeting in Chicago of the American Association for the Advancement of Science. This session was sponsored jointly by the A.A.A.S Cooperative Committee on the Teaching of Science and Mathematics and the National Science Teachers Association. Abstracts of the papers appear here.

*Members of the A.A.A.S. Cooperative Committee.

Science in General Education

DR. VIVIAN JOHNSON

Department of Physics
Purdue University

Abstract

General education aims to give the student (1) a firmly rooted love for learning, (2) personal adjustment to his environment, (3) competence in a vocational area, (4) an awareness of the complexities encountered in human relationships. A science course in general education is designed to emphasize (1) the historical development of science, (2) an understanding of the scientific

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Conference on Industry-Science Teaching Relations

National Science Teachers Association Hotel Sherman, Chicago, December 28

THE NEED for finding ways in which industry and science teachers can cooperate effectively through desirable industry-educational programs was the principle theme of the conference on Industry-Science Teaching Relations, held at the Hotel Sherman in Chicago on December 28.

Presenting the problem to the group, Mr. G. Edward Pendray, Public Relations Counsel for Industry and chairman of the meeting, pointed out that "Education is big business. It has a big stake in the amount and kind of science teaching in our schools, and the schools could derive great benefits from industrial research and other activities, particularly at this critical time. It is therefore essential that these two groups should learn to cooperate effectively."

Speaking on behalf of educators who are concerned with all science information that can make a socially valuable contribution to our schools, Dr. Thomas H. Briggs, Director of the Consumer Education Study of the National Association of Secondary School Principals, stressed the importance of science information of industry in an education program. Emphasizing the fact that our schools are "Modern Miracles of the World," he continued by saying that "all contributions should be viewed in the light of whether they contribute to making our system of schools a better one, and whether they are justifiable in a program of education." He gave a brief digest of the activities of The Consumer Education Study of the National Association of Secondary School Principals, and particularly its work in making a study of hundreds of available business educational pamphlets in an attempt to determine the kinds of materials most suited for classroom use. One of the important phases of the project was the preparation of certain guiding criteria for industries interested in the production of educational materials.

PRESENTING the industrial point of view, Mr. Ivan L. Willis, Vice President in charge of Industrial Relations, International Harvester Company, said that one of the essential means of bridging the gap between industry and education is the general improvement of science teaching. "Both industry and the schools," said Mr. Willis, "have a part to play in making science teaching more effective. While industry can not and should not dominate the educational program, it can cooperate and make suggestions. It is in a good position to evaluate the training which students get in schools. The motives of industry are naturally selfish. They must hire the best employees they can get; profits must be justified in terms of the social good they achieve. But our system of free enterprise is a social institution which must be understood and properly interpreted by the schools."

Dr. Morris Meister, President of the National Science Teachers Association, brought to a focus the problems of the distribution of science information and the need for trained personnel of industry as they relate to the instruction within the classroom. He pointed out that more than a million teachers and more than fifty million people are engaged in the business of education. What these millions think and why they behave as they do must be important to industry. Quite apart from the markets for industry's products which they represent, the classrooms of the nation can and do condition the kind, the quantity, and the quality of goods and services produced. Out of the nation's classrooms comes the personnel, whose intelligence, energy and skill are needed to keep the wheels of industry turning. In these classrooms sit young men and women who will shortly furnish the ideas and the creative genius that will improve, modify and revolutionize technology.

Most important of all the classrooms are places where youth obtains knowledge and understanding of and develops attitudes towards our American way of life. Dr. Meister emphasized that "Since industry and science teaching are partners in the enterprise it is important that good relations between them

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This and That

NORMAN R. D. JONES
Vice-President and Membership Chairman

Vaden W. Miles of Boston University recently accepted a position at Indiana University.

Mr. J. S. Richardson of Miami, Ohio is now at Ohio University.

Dr. John Read who has served as our state director for Rhode Island for the past several years is now at Boston University. Dr. Robert K. Carleton is also transferring to Boston University.

Mr. Ernest M. Hanson, who for many years has served as our state director in Utah and Assistant Superintendent of the Salt Lake City Schools, began his duties as Superintendent of Schools in Pueblo, Colorado the first of January. Congratulations.

Mr. H. S. Kerns, an area director for Alabama, is working on his Doctorate at Columbia University.

Dr. Morris Meister, N.S.T.A. president, spoke before the American Chemical Society at its meeting in Buffalo the last of January. Through the efforts of area directors, Dick Lape and Donald Kumro, a very successful N.S.T.A. meeting for that area was planned so that Dr. Meister could meet with them also.

Dr. Paul E. Blackwood, formerly of Ohio State University, is now at the U. S. Office of Education.

Richard D. Huxley is teaching at the Punchore School in Honolua, T. H.

Several N.S.T.A. members were present at the Sunday morning Science Clubs of America-Cooperators breakfast, held at the time of the A.A.A.S. meeting in Chicago.

Membership-Doubled-Ahead

Mr. Keith Johnson, Washington, D. C. Director and Supervisor of the Schools of District 1-9, and his teachers have made the best membership percentage of increase showing to date, practically doubling their record of last year. Congraulations on this fine showing.

Many others have made excellent showings to date. Oregon recently had 31 more to report. Mr. McArthur reported an excellent Louisiana Science meeting at Alexander. Miss Julia Armstrong also reported an excellent science sectional meeting in connection with the North Dakota State Educational Convention. Mr. Taggert prepared a very interesting meeting for the December meeting of the Southern California Science Teachers Association. Other meetings will soon be held and we hope equally productive in membership.

Will our goal of 6,000 be reached? We are now about halfway there which is way ahead of our record set last year. *IF EACH OF YOU* would secure *1* additional member our goal could be surpassed. *How about it?*

Thanks

"Your magazine makes me more optimistic about the future status of science teaching, if only the rest of the teachers can be exposed to the stimulating ideas therein," was recently written to us. Suggestions for making our magazine more helpful will be appreciated.

Honoring Directors

We are carrying our list of loyal State and Area Directors in this issue, honoring them for the many hours of work that they "put in" for N.S.T.A. These are our contacts on the local front.

New Area Directors

Miss Pauline Royt, Rufus King H. S., Milwaukee 12, Wisconsin.

Sr. M. Jude, 1226 E. 55th, Chicago 15, Illinois.

Western A.A.A.S. Meeting

One of our 3 very active California Science Teacher groups—The Northern Section—will be host organization for the N.S.T.A. program at the Western Division Meeting of the A.A.A.S. to be held in San Francisco the last of June.

It is hoped that as many of our Western Area members as possible will plan to be present at this meeting.

Mr. Edward Long, Chairman, and his committee will have a very worthwhile program for you, as did the committee in charge of last year's program.

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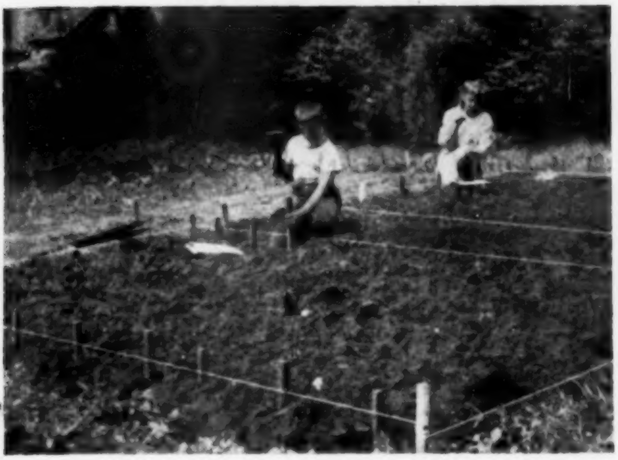
Children's Gardens Should be Planned for Children



Laying out vegentable garden No. 1 in the backyard at home.

PAUL R. YOUNG*

Board of Education, Cleveland, Ohio

ONE OF THE most frequent reasons for failure of boys' and girls' gardens is poor planning. Youngsters should begin their gardening with projects planned for their level of interest and effort. Too often they attempt an adult garden, with discouragement and lack of interest as a result.

In the course of much experience in planning gardens for children, a few fundamental principles have been proven and are here given.

Size

Gardens for boys and girls should be small. It should be possible for them to finish the work required at any one time while the activity is yet fun. When the work period is too long, interest lags and what was fun becomes drudgery. If this is repeated too often the whole project loses its attraction for the youngsters and its value as an educational activity. The garden work period must correspond to the short span of active interest characteristic of boys and girls.

Definiteness

Gardens for boys and girls should be planned. When most adult beginners find it difficult to plan a garden for themselves, it is folly to expect youngsters to work out their own. A definite plan for the garden to be planted, and some instruction in its use as a guide to actual planting, are essential to success.

*School Garden Supervisor, Board of Education, Cleveland, Ohio.

Simplicity

Gardens for boys and girls should be simple. A few short rows are enough. Spacing between rows should be in easily measured distances. It is not difficult to teach how to translate such a plan into an actual garden, nor for the children to actually do it at home after such instruction.

Crops

Gardens for boys and girls should contain only crops of easy culture and proved productiveness. This rules out many otherwise desirable plants and varieties, which require specialized care and growing conditions which children and the average back yard are not able to provide. Vegetables are easier to grow than most flowers and quicker to show results, so the first garden may well be a vegetable garden. It appeals to an elemental interest in food production that seems to exist during childhood, taking precedence over the interest in flowers.

Cost

Gardens for boys and girls should be inexpensive. Neither youngsters nor parents are ordinarily willing to invest too much in a gardening project with no experience of success to encourage them. The investment should be small so that not much will be lost if the harvest of the first garden is meager. Cost for seeds and plants can be kept low by group

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Garden No. 1 as it begins to grow.

Simplicity in Demonstrating Physics*

RICHARD M. SUTTON

Chairman, Department of Physics
Haverford College

PHYSICS is one of the most exacting subjects in the curriculum, but it can also be one of the most fascinating. Whether students look upon it as dull drudgery or study it with enthusiasm depends upon how it is taught. If it is presented as a collection of cold facts and formulas to be learned, and beastly problems to be solved, it can drive students away by the hundreds. But if it is rescued from the textbooks and brought to life, if it reminds the student of the hundreds of every day occurrences that are better understood by a knowledge of its principles, then physics can be exciting. The best way to make a new principle vivid is to "bring in a sample" by showing an experiment that makes abstract ideas more concrete. The score of demonstration experiments that I shall present are chosen from hundreds that might be shown. They are meant to be suggestive of the kind of thing that enlivens a class in physics. They are simple experiments performed with simple apparatus much of which is homemade or readily obtainable locally. These particular experiments have been selected because they are more easily performed away from home in the absence of the usual facilities of the laboratory. Some experiments are more readily transplanted than others. All of them are pets of mine, and some of them are my own "children."

Regardless of parentage, a good experiment is a good experiment and worth showing. If you see twenty experiments in the next fifty minutes, it does not mean that you have to go home and cook up twenty experiments for every class period. A steady stream of two or three good experiments in each class hour is perhaps enough to keep interest at a high level. An important ingredient of any experiment is *imagination*: imagination in its preparation and presentation. Even old experiments may be new to the student, and they may be presented without apology if they really show an important principle. There is a certain indispensable element of showmanship involved in presenting experiments with proper timing and emphasis. If you, as a teacher, can feel at the end of a year that you have developed or improved even five or six useful experiments, then there is no danger of your going to seed or of becoming stale on your subject. Don't be afraid to follow the principles of physics in new directions.

NO PART of my work delights me more than the concocting of new experiments. Every now and then a "brain storm" breaks and there is no shelter from it but to go to the shop or the lab or the five-and-ten-cent store to draw together a few pieces of apparatus in some new combination, or to make a new gadget that no one ever saw before, just to see if it can throw new light on the things we talk about in physics but seldom take the trouble to show.

Rather than list a lot of rules for showing demonstration experiments, let us turn to a few experiments to see if they will not themselves teach us some of the rules. Before proceeding, I wish to introduce to you Mr. Philip Tapley of the Chicago school system who has given me invaluable assistance in assembling apparatus, and who will act as my assistant.

First, here is a simple arrangement for making graphic the meaning of the common units of work and power. If I raise this one pound weight against gravity to the top of a twelve-inch pedestal, I have exerted a one pound force through a distance of one foot and have done *one foot-pound* of work. The weight now has 1 ft.-lb. of potential energy which it did not have before. Likewise, I could raise this one kilogram weight to the top of a meter stick and do one kilogram-meter of work. Both of these are "gravitational units," but the *joule* is also an inescapable "absolute unit" of work, related as it is to the watt and the kilowatt-hour. How does the joule compare with the foot-pound? As

*Text of paper given at joint meeting of the National Science Teachers Association and the A.A.A.S. Committee on Science Teaching at Chicago, Ill., December 29th, 1947. (Modified for publication in THE SCIENCE TEACHER.)

you see, I must raise this one pound weight only about 9 inches to do *one joule* of work, for a joule is slightly less than $\frac{3}{4}$ foot-pound. Or if I raise this kilogram to the top of a small pedestal, 10.2 cm high, I have also done a joule of work. In the meter-kilogram-second system, the unit of force is the *newton*, or one hundred thousand dynes, equal to the weight of 102 grams of mass. Therefore, if I raise this 100 gram weight one meter, I have done nearly *one newton-meter* of work, and one newton-meter is the same thing as a *joule*. And how about those tiny little ergs? If I raise this nickel (5 grams weight) only the height of a sheet of paper, I must do about *50 ergs* of work. No wonder it takes a lot of ergs to do the world's work. The electric companies give you 36 million-million of them for the price of one kilowatt-hour!

Now, how about the units of power? If I raise this kilogram weight 10.2 cm in one second, I am working at the rate of *one watt*. That is easy. But how about the *kilowatt?* That means raising 1,000 kilograms (more than one ton) to the top of this same pedestal (more than 4 inches) in one second. Not so easy! And the *horsepower* would require lifting a 550-pound weight to the top of the one-foot pedestal in one second. At best, you wouldn't want to do that for very many seconds. The *kilowatt-hour* is a unit of work (not power) that represents 3.6 million joules, or about 2.7 million foot-pounds. To do that much work, I should have to raise those 1,000 kilograms nearly as high as the Empire State Building! That is more work than a strong man would do in a day.

The moral of this experiment: "Make abstract ideas concrete." Act them out, make them vivid. *Grunt* when you struggle to lift an imaginary 550-pound load to the top of that pedestal one foot high.

SECOND, a simple torque device for teaching the ideas of moment of force and lever arm. Here is a steel rod, $\frac{1}{4}$-inch in diameter and 30 inches long, set in a transverse handle $1\frac{1}{2}$ inches in diameter. A 2-pound weight is hung from the rod by means of a movable hook. When the hook is near the handle, the rod may be held horizontally with ease. But when the hook is moved to the far end, it takes real muscular effort to hold the rod horizontal. The torque is now 60 lb.-in., but the torque falls to zero if the rod is allowed to drop down until the pull of gravity is directed through the point of support. The same weight may cause any torque from zero to 60 lb.-in., depending upon the position of the rod and the corresponding length of lever arm.

Moral: "Teach physics through the muscles." Any student who has actually handled this arrangement is not likely to misunderstand the meaning of lever arm and moment of force, or torque.

Third, here is a 50-pound block of iron whose inertial properties require our attention. It is hard to change the velocity of this block suddenly. If I rest it on top of my head, Mr. Tapley can drive nails into a block of wood placed on top of the iron without hurting me. The blows of the hammer exert great force on the nail for short intervals of time, and equal forces on the iron. But these impulses given to the iron do not succeed in giving it any appreciable speed. The chief discomfort which I feel comes from the steady load of 50 pounds upon my head, and the hammer blows bother me scarcely at all. It does not take a hard-headed person to perform this experiment.

Moral: "Drive the principles of physics home graphically and dramatically."

FOURTH, this same iron block is now resting on a plank free to move on two rollers (two ordinary lab rods). You see that there is so little friction that I can pull the weight along the table with this thread. I have attached a piece of rope clothesline to the weight, and a hammer is fastened to the other end of the rope. The rope is strong enough to support my 160 pounds weight, and yet I can break the rope by a swift snap with the hammer. Watch now as the hammer whips past the weight and suddenly attempts to accelerate it. You see that, as the hammer draws up the slack, the rope breaks but the 50-pound weight is scarcely disturbed. The force acting on the weight was in excess of 160 lb., and an equal and opposite force acted upon the hammer to slow it down, but these forces acted for such a short length of

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A Model of the Solar System

FLETCHER G. WATSON

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Harvard University

WHEN attempting to give some concept of the position and size of the earth in relation to the other members of the solar system, the use of large numbers, such as 93,000,000 miles for the distance between the earth and sun, is not likely to carry much significance to the student. Diagrams are also of little value for they necessarily distort the sizes of the planets relative to the spaces between them.

Creation of a simple model of the solar system on a small scale can be done rapidly and with the cooperation of the class. It is unlikely that anyone who has seen such a scale will ever thereafter have a seriously erroneous concept of how tiny the earth is compared to the enormous spacings of the planets. In the following table the actual diameters and mean distances of the planets from the sun are listed and then scaled down to reduce the sun's diameter of 864,000 miles to 3 inches, easily represented by an orange, a light bulb, or a Christmas tree ornament. The relative sizes and distances to the several planets are given with suggestions of typical objects that may be used to represent them. It is recommended that this model be set up along a corridor at least 150 feet in length so that Jupiter's position can be shown.

WHEN SUCH a model is before the class, the instructor can also point out a number of other characteristics of the solar system:

1. That the planetary orbits are nearly circular, thus the individual planets always remain separated by considerable distances;
2. That the orbits of all the planets lie in nearly the same plane (perhaps the floor of the corridor) with the largest orbital inclinations occurring for the extreme planets, 7° for the orbit of Mercury, and 17° for that of Pluto;
3. That the planets all move around the sun in the same direction, counterclockwise as seen from above the north pole of the sun;
4. That the planets, with the single exception of Uranus, rotate in the same direction as their orbital motion—counterclockwise.

The highly organized and stable system of the planets can then be contrasted with the erratic orientations of cometary motions. The extreme isolatoin of the stars, even in this relatively crowded part of space, is evident when the nearest star is represented by a second orange some 1,800 miles away.

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Scale Model of the Solar System

Object	Solar Dist. (Astro. Units)*	Diam. (miles)	Period about sun (years)	Solar Dist. (feet)	Diam. (inches)	Typical Object
Sun	....	864,000	....	....	3.0	Orange
Mercury	0.39	3,100	0.24	10.5	0.010	Grain of sand
Venus	0.72	7,700	0.61	19.	0.027	Pin head
Earth	1.00	7,900	1.00	27.	0.027	Pin head
Mars	1.52	4,200	1.88	41.	0.014	Grain of sand
Jupiter	5.20	88,600	11.86	140	0.30	Child's marble
Saturn	9.53	74,100	29.46	266	0.25	Pea
Uranus	19.19	32,000	84.02	516	0.11	Large pin head
Neptune	30.07	31,000	164.97	810	0.11	Large pin head
Pluto	39.5	6,000?	247.70	1060	0.02?	Pin head

* The "astronomical unit" is the average distance of the earth from the sun, very nearly 93,000,000 miles.

On this scale the moon is 0.007 inches in diameter and 0.87 inches from the earth. The nearest star is another orange some 1,800 miles away.

Teaching Science for the Atomic Age

(Continued from December Issue)

ALEX B. NOVIKOFF

Biology Department,
Brooklyn College

THE PROBLEM of a "Science Sequence" and the so-called "articulation" between courses at different levels is clearly no simple matter. The only chance for an adequate solution of the problem lies in cooperation among science teachers at all levels—teachers who are willing to listen and learn as well as talk and inform, who are ready to give up some of their vested interests, who will not cling to the traditional way if there is a better way, who appreciate current trends in society because they are themselves taking part in life outside the classroom or laboratory, who see the relation of their subject matter to these social events, who sense the needs and feelings of the students, and who are aware of the current major developments in their subject.

Even those primarily interested in the training of specialists should be deeply concerned with the integration of science teaching at all levels. In the field of biology it is becoming well nigh impossible to train students adequately for many important fields of research in the present amount of time spent in undergraduate and graduate work. Advanced work in chemistry, and a good deal of mathematics and physics are as vital as the biological subjects.

THIS SUGGESTS that we begin our science teaching earlier, that we do it better, and that we not duplicate work done on lower levels except where desirable. We need to know the answers to such questions as: How much duplication of material is there in the high school and first year college science courses? How well do high school and college courses achieve the purposes set for themselves? How widespread is the practice of prescribing the same freshman college course for those who have had the particular science in high school and for those who have not? How do those who have had a subject in high school fare in a freshman course as compared with those who have not?

At Brooklyn College, students electing Chemistry are assigned to Chemistry 1 if they have had high school chemistry and to 01 if they have not had it in high school. But the student who has had high school chemistry gains no time in college; both Chemistry 1 and Chemistry 01 students have to take a year's work to satisfy the college science requirement or to qualify for electives in chemistry. Students electing biology all begin with the same course, Biology 1. Again a student gains no time by having taken biology in high school.

In the fall of 1945, there were 592 students enrolled in Biology 1, of whom 74.8% had had a year of high school biology in addition to a year course in general science, and 25.2% had not. A comparison of the final grades of the two groups revealed that the group with high school biology did not do appreciably better than those without it. Of course, what this signifies cannot be determined without considering other facts. Perhaps it means that students do not carry over much from their high school biology, or that the college Biology 1 is entirely different from high school biology, or that the basis of grading students in college Biology 1 is questionable, or that students who have had biology in high school do not work as hard as those who have not had it before. Whatever the reasons for the absence of a sharp difference in achievement of the two groups, this I believe is clear: it is a situation which needs analysis and remedy.

More data of this sort must be obtained, from all levels of instruction. And, to enable us to interpret them, we need to examine syllabi and examinations in the courses, and to sample adequately the opinions of the students involved.

EMERGING from the cooperative efforts of science teachers of all levels must be a clear understanding of the distinct tasks of each level as well as the tasks common to all. In delimiting our special tasks, we must guard

5—"Text of the New Kilgore-Magnuson Bill", *Science*, vol. 103, 1946, p. 225.

against a number of notions, all too prevalent today:

1. That accumulations of complicated vocabulary—collecting tags for cells, bones, plants, animals—is synonymous with increasing scholarship.
2. That new facts and ideas must be saved for the more advanced levels of instruction. We will readily agree that it is not desirable to teach new ideas simply because they are new; but neither is it desirable to teach material simply because we learned it some ten years ago and our teachers some ten years before that. Dr. Lark-Horovitz, Head of the Department of Physics at Purdue University and Chairman of the American Association of Physics Teachers Committee on Teaching in Secondary Schools, wrote recently "the teaching and the methods still used in the natural sciences, with the exception of the biological sciences, are so antiquated that one could take any textbook of fifty years ago, loosely add a few chapters stressing modern developments, and use it as successfully as any recently printed text."[7]

   And even in biology we can point to many matters still treated as they were when we, and biology, were young. Enzymes, of prime importance for an understanding of cell function, are mentioned in almost all high school and college texts only in the discussion of digestion. The digestive enzymes are produced in cell metabolism, and metabolism is largely controlled by enzymes within the cells. Without knowing about the intracellular enzymes, you cannot understand why vitamins, or hormones, or genes are important. The discussion of genetics includes 3:1 crosses, and often 9:3:3:1 crosses, but hardly a word on what genes are, how they operate, and how they are interrelated with cytoplasmic and other environments. Students are asked to know ptyalin, pepsin and many other digestive enzymes, but are kept from hearing of the truly exciting experiments which demonstrate why digestive juices are produced, and show the cause and effect relations of the activity of the digestive tract.
3. That examples such as I have just listed are too "advanced", too "technical" They are not; they can be simply presented, as I have found in writing for 12-year olds and in teaching adults with no science background whatever.
4. That fundamentals cannot be taught at lower levels and must be saved for college. When we ourselves are aware of the fundamentals, we will soon discover at what level we can begin to teach them.
5. That as you go up the scale your material should become more removed from everyday personal and social life, less "practical," so as to permit you to stress fundamental principles. But there is no conflict between "practical" and "fundamental". We have already suggested that the most meaningful way to teach fundamental principles is through "practical" examples from everyday life. Judging from the innovations suggested in the 1942 Biology Syllabus of the New York Association of Biology Teachers, this has been the experience of high school teachers. Photosynthesis is not discussed in the tradition of ivory-tower botany, but in relation to man's food needs. Study of blood circulation includes discussion of shock and plasma transfusions, problems of the aviator, and first aid. The study of race, with inclusion of anthropological data, is emphasized. We at Brooklyn College have had the same experience. By revising the traditional first year course so that it became man-centered and had many points of contact with current life, the teaching of fundamental principles was facilitated, not hindered.

There is one important area where even the 1942 High School Syllabus carefully avoids becoming too practical or meaningful; that is on the subject of reproduction. In the textbooks and syllabi used in the New York High School General Science, Biology, and Health course, there is this glaring omission. Much discussion of conjugation in Spirogyra and Paramecium, the development of the frog or chick, even alternation of generations in ferns—but not a word on human sex organs and reproduction! In an area where so much can

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7—Lark-Horovitz: "Science in the Schools of Tomorrow".

Science Clubs at Work

Edited by MARGARET E. PATTERSON

Secretary, Science Clubs of America

• A department devoted to the recognition of the splendid work being done by science club members and their sponsors. Material for this department, such as student made projects; demonstrations and posters; outstanding club programs; state and regional meeting announcements; should be sent to Miss Patterson, Science Clubs of America, 1719 N Street, N. W., Washington 6, D. C.

Junior Scientists Assemble in Chicago

THE YOUNGEST scientists attending the mid-winter meeting of the American Association for the Advancement of Science in Chicago formed the panel that spoke before the Junior Scientists' Assembly. Ranging in age from 17 to 24 and in academic standing from high school senior to doctoral candidate, they met to tell each other and assembled members of the AAAS and the National Science Teachers Association how boys and girls first set their feet on the long trail of scientific research.

The Junior Scientists' Assembly was patterned after the first one held so successfully at the Boston AAAS under the direction of Dr. Herbert Zim. Dr. John W. Thomson, Jr. had the pleasure of acting as the director this time and thoroughly enjoyed becoming acquainted with the 14 high school and college students who were chosen as the 1947 panel of junior scientists. Though they came from six different states, and represented many high schools and colleges, there was much agreement in their thinking on the problem at hand. Now only at the beginning of their scientific careers they are already promising research workers and therefore in a position to express their opinions on what makes scientists succeed.

Research Reported

A LARGE audience of scientists, educators and students crowded the Louis XVI Room at the Hotel Sherman to listen to a lively discussion of "The Importance of Extra-Curricular Science Activities to Science-Talented Youth."

If the audience had any doubt that the panel members were competent young scien-

Left to right: Ellis, McLeish, Noland, Palombi. Robert Palombi speaks emphatically to the audience at the Junior Scientists Panel in Chicago, December 27, 1947, while fellow Science Talent Search winners await their turn to voice opinions.

Credit: ACME

tists they were convinced when five of them reported on their past or present research projects. The five speakers were:

Carl H. Stapel, a senior in Appleton (Wis.) H. S., holder of an amateur radio license, now doing advanced work in the field of FM radio. For his proficiency in radio and electronics, which he has studied since he was 12, the Wisconsin Academy of Science last year elected him an honorary member.

Alfred P. Peaslee, Jr., of Dubuque, Iowa, senior at Phillips Exeter Academy, Exeter, N. H., plans to be a theoretical physicist. He spoke briefly on his studies of the phosphorescent effects produced when crystals of common table salt are exposed to intense X-rays. Some of the work was done last summer when he was employed in the apparatus department of the Marine Biological Laboratory at Woods Hole, Mass.

Evelyn A. Pease reported on her work in synthesizing sulfa drugs, carried on in her home town of Evansville, Ind., when she was employed during her early college years by Mead Johnson and Co. Her interest in science, beginning at age seven, grew from grade school adventures with collecting rocks, birds' nests and flowers to serious study of chemistry in her high school days when she was named a winner in the First Science Talent Search (1942). Now a teaching fellow at the University of Michigan, she is working toward an advanced degree in biochemistry. Her specialty is the metabolism of the amino acids.

Jean Carol Ross of Hammond, Ind., a recent graduate of Rockford College, reported on her work as a junior technician with the Sinclair Development Co. in East Chicago. There she handles analytical and ultra-violet spectroscopy. Interest in science started in her early school days, developed during high school when she was active in the Indiana Junior Academy and was also a winner in the 1942 Search. In college she worked with the Illinois Junior Academy of Science. She is continuing her studies in night classes at the University of Indiana.

Irving Rozian of Hazel Park, Mich., a Search winner in 1944, reported on his most recent research project at the University of Michigan. This is an electronic device to aid in the analysis of electrocardiograms to improve diagnosis of various heart ailments. Mr. Rozian developed a wide interest in science very early in his school career and during his years at the University has done research—some of it on wartime secret projects—in electronics, physics, and chemistry. He plans to acquire degrees in physics, engineering and business administration before establishing a research service.

Panel Members Outstanding

THIS preliminary research-reporting indicated conclusively that encouraging practice in science among boys and girls can make it possible for some of them to do advanced work at an early age.

The chairman of the panel, Paul E. Teschan, then introduced the remaining members of the panel, all chosen for their outstanding work in science.

Three of the members hold honorary memberships in the AAAS.

CHAIRMAN Teschan ably guided the discussion of the panel by introducing such questions as "How did you get started in science?", "What were your experiences in science clubs?", "Which science teachers were most helpful in guiding your career?", "What outside agencies supplemented your school program in science?".

After a rapid-fire panel discussion, the chairman threw the meeting open to questions from the floor and adults and students in the audience added to the stimulation of the program by asking pertinent questions of the "experts".

Dr. Zim Summarizes

Dr. Herbert Zim, as he had in Boston, summarized the afternoon's discussion. He emphasized the point made over and over during the meeting that opportunities in science outside-of-school hours or away from school are determining factors in the development of young scientists.

Home encouragement, science clubs, contact with adult scientists, were all stressed by the panel members as influences that steered them into science careers.

Scientific toys and adolescent experimental apparatus kept their early interest in science alive.

Left to right: Rabedeau, Teschan, Ross, Rozian. Answering questions f r o(m the floor lent enjoyment to the panel discussion. Here, Paul E. Teschan, chairman of the panel, humorously answers a query while his fellow panel members enjoy the joke.

Credit: ACME

ALL WHO had had the experience spoke enthusiastically of the influence of state and national organizations, especially when those enabled them to meet and compare their work with other young scientists and become acquainted with adults already working professionally in science.

Dr. Zim reemphasized the point made by the panel that it is necessary to "practice" in science and that it is important to start early and learn to face and overcome failures that are inevitable in order to develop the stamina and persistence required of scientists.

He noted with pleasure that these young people tended to deglamorize science because they were already so far along in it they recognized that success in it constitutes long hours of hard work with "sudden success" a rarity.

A necessity to work in science in a job situation was a point made both by the panel and by remarks from the audience and though it is not easy to break into science at an early age. Dr. Zim reiterated the need to make every effort to help students get work experience as early as possible in their careers. If necessary working as a volunteer is worth it for the experience gained.

Another Assembly Planned

THE afternoon ended long before an interested audience had all its questions answered. It was clear that students, educators, and scientists found this Junior Scientists' Assembly an impetus to their own efforts in science. The enthusiasm gave every indication that another Junior Scientists' Assembly would be welcome. Plans are therefore going forward to hold one in Washington D. C., next Christmas when a new panel of young scientists will be introduced to a new audience.

Assembly Caldwell Inspired

The late Dr. Otis W. Caldwell was responsible for the idea of the Junior Scientists' Assembly. The first one in Boston was carried through at his instigation under the chairman of the committee, Dr. Morris Meister. Just prior to his death in July Dr. Caldwell was making plans for the Chicago Assembly. These plans were carried out by a committee composed of:

Dr. Morris Meister, Chairman, Principal, Bronx High School of Science, New York City and President, National Science Teachers Association.

Dr. Herbert S. Zim, Science Consultant, Manhasset Bay School, New York City.

Dr. John W. Thomson, Jr., Assistant Professor of Botany, University of Wisconsin, and chairman of the Junior Academy Committee, Wisconsin Academy of Sciences, Arts and Letters.

Miss Margaret E. Patterson, Secretary, Science Clubs of America, Washington, D. C.

Mrs. Mary Creager, Eastern Illinois State College, Charleston.

J. H. Ward, Classical High School, Providence, R. I.

Dr. Hugh C. Muldoon, Duquesne University, Pittsburgh.

John C. Hogg, Phillips Exeter Academy, Exeter, N. H.

All panel members were guests of the NSTA on December 29 at a memorial luncheon for Dr. Caldwell.

Chats With Science Teachers II

Science and Poetry

HANOR A. WEBB

Department of Science Education
George Peabody College for Teachers
Nashville, Tennessee
Secretary National Science Teachers Association

"Prose—words in their best order; poetry —the best words in their best order." *Samuel T. Coleridge* (1772-1834) of England.

Do you like a bit of poetry with your science, like a lump (one? two?) of sugar in your tea? If so, you are in the company of many great thinkers, and most of the young folks.

Of course you don't teach facts and formulas in verse. But, as George Herbert (1593-1632), the Welsh poet and teacher, expressed it, "a verse may finde him who a sermon flies." It will aid your lessons if you call on imagination, a higher mental power than mere memory. The essence of a poem is the challenge to human powers of understanding and appreciation. Only dullards dislike poetry.

POETS FIND science, in the form of nature, more interesting than love. (Perhaps love, too, is nature!) Oliver Wendell Holmes (1804-1894), the American poet who so well combined wit and sublimity, wrote one of the greatest poems in all literature about *The Chambered Nautilus*. John Keats (1796-1821) of England rhymed *On the Grasshopper and Cricket*. James Thomson (1700-1748) of Scotland wrote the most vivid descriptions of weather in *The Seasons*. Practically every bird, flower and tree has been studied with poetic insight. The sea, the mountains, the sky, the fields—the list of nature's wonders that have inspired poets is almost endless!

There are several tested ways to bring poetry into the science classroom, to please yourself and the young folks. The simplest plan is to have a short quotation written on the blackboard each morning, expressing a thought related to natural science. Hundreds of these, mostly parts of poems, are in the standard quotation books. Two of the largest collections are *Familiar Quotations* by John Bartlett (Little, Brown & Co., New York), and *New Cyclopedia of Practical Quotations* by J. K. Hoyt (Funk & Wagnalls, New York). These, and others, are probably in your school library.

Of course you will let the students do the picking, singly or in small groups, for a day or a week. You will see that the blackboard writing is neatly done in large handwriting or lettering. The full names, dates, and countries of the poets should be given. You will guide the students in their selections for variety, as the sea—

> Why does the sea moan evermore?
>   It frets against the boundary shore;
> All earth's full rivers can not fill
>   The sea, that drinking, thirsteth still.
> —*Christian Rossetti* (1830-1894) of England.

the sky—

> . . . Heaven's ebon vault
> Studded with stars unutterably bright,
> Through which the moon's unclouded grandeur rolls,
> Seems like a canopy which love has spread
> To curtain the sleeping world.
> —*Percy Bysshe Shelley* (1792-1822) of England.

the dawn—

> O'er night's brim, day boils at last;
> Boils, pure gold, o'er the cloud-cup's brim.
> —*Robert Browning* (1812-1889) of England.

and dusk—

> Now twilight lets her curtain down
> And pins it with a star.
> —*Lydia Child* (1802-1880) of the United States.

the planets—

> And through these sweet fields go
>   Wanderers amid the stars—
> Venus, Mercury, Uranus, Neptune,
>   Saturn, Jupiter, Mars.
> —*Walter de la Mare* (1873-) of England.

the sun—the moon—the mountains and plains —daisies, lilies, roses, violets—birds, bees, cats and dogs, fleas and flies—each tree you know—electricity—waterfalls, lakes, and rivers—indeed, all familiar nature! We have looked up quotations from each topic mentioned in the lines above—and many more!

Let your quotations be seasonal, too. There

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Science for Society

EDITED BY JOSEPH SINGERMAN

• A department in which science is presented in its close relationship to the individual and in which guidance is given in causing the individual to recognize the methods of science and its vast social implications.

Kinsey's Study of Sexual Behaviour

JOSEPH SINGERMAN

High School of Commerce, New York City

SEXUAL BEHAVIOUR IN THE HUMAN MALE. Alfred C. Kinsey, Dardell B. Pomeroy, Clyde E. Martin. 804 pages. 173 charts, 159 tables. $6.50. W. B. Saunders Co., Philadelphia 5, Pa. 1948.

Milestone in Sex Understanding.

Kinsey's book is destined to be recognized as a milestone in the field of human sex understanding. Educators will go to this and to forthcoming reports of Kinsey and his coworkers for scientific information, for an unemotional, objective, reliable recording of human sex experiences.

SEX EDUCATION is still largely dominated by emphasis on attitudes of shame, embarrasment, and fear of disease in regard to sex relations, rather than a wholesome understanding of its role in personal adjustment and social living. This is due largely to a lack of authentic information on the subject. Kinsey's report, of which this is to be the first, will help meet this need.

You will recall the case of seventeen year old William Heirens who dismembered the body of the Degnan girl. When New York neuropsychiatrist Foster Kennedy examined him, Heirens calmly related the gruesome details of the dismemberment as well as those of two previous slayings. But, when Dr. Kennedy questioned him about his petting parties, the youth broke down and sobbed. When questioned as to which he considered worse, murder or sex, the boy replied, "Sex." Dr. Kennedy reported that the only sex education he ever received directly from his elders was when, at the age of ten, he was told, "If you ever touch a girl, you will get a terrible disease." Dr. Kennedy found no justification for assuming that William Heirens' lack of wholesome sex education was a major factor in his criminal inclination. But, he did say, "I believe it was a significant factor."

This, to be sure, is an extreme example. But it does make a point. How many people have entered adulthood with mental and emotional conflicts, because of faulty sex education during childhood and adolescence, that interfered with personal, social and marital adjustment?

Covers Wide Range of Population

Dr. Kinsey's book is a preliminary report on a nine year taxonomic investigation, through personal interviews, of the sex experiences of certain segments of the American white male population. It is based on the histories of 53,000 males, ranging from youth through old age, selected to represent different educational, social and economic levels, of different religious persuasion, incorporating representation from the underworld as well as from "the 400." Negroes will be included in future reports when a sufficient number of cases will have been interviewed. However, preliminary examination of the information indicates that Negroes will fall into classification similar to that of the white segment of the population. Among future reports to be published there will also be included one on sex experience of the American female.

AT THE conclusion of each interview, the subject was afforded an opportunity to obtain information about some items affecting his personal life. Among the more frequent questions reported were those concerning the following problems: "Possible harmful effects from 'excessive' sexual activity. Physical harm resulting from masturbation.

Incidences of masturbation, pre-marital intercourse, . . . mouth-genital contacts, homosexual relations, animal contact. 'Am I normal?' Physical and social significance of petting. Relation of pre-marital experience to subsequent adjustment in marriage." It would be interesting and instructive to determine what effects answers to these questions may have on subsequent adjustment of the individual. This is but one of countless possible research problems that may grow out of this investigation.

One may presume that popular interest in this book might be stimulated by people's purportedly innate curiosity in regard to the private affairs of their fellow creatures. But, it would not be fair to place the matter as simply as that. It is perfectly proper, and one has a right, to know how his own sex experineces compare with those of his fellowmen. Incidentally, that is the only satisfactory approach to any attempt to satisfy one's question as to what is normal and what is abnormal. Surprisingly, there is no simple direct answer to this question, nor does the text attempt to give one. But a study of the data in this report will set any man's mind at rest in this regard. The report itself is the answer.

Facts Important to Educators

THOSE who are concerned with education, and more particularly with any aspect of reproduction or of sex education will find this report one of inestimable value. Following are examples of data which these people will find particularly interesting. Quotations are from the Kinsey report.

During pre-adolescence, 22 percent of boys have made attempt to effect genital union. The incidence is greater in lower social levels and lower among those destined to go to college. In the lower levels, actual penetration is often involved and "the children have what amounts to real intercourse," culminating in orgasm, but without ejaculation.

An occasional boy in third or fourth grade is sexually as mature as an occasional senior in college. The mean age of first ejaculation is 13.55 years. It is somewhat earlier for the group destined to go to college (upper educational level), and later for those destined not to go beyond elementary education (low educational level). Dr. Kinsey suggests this may be due to nutritional inequalities at different social levels, though he offers no evidence.

First ejaculation is a result of masturbation with 68.39 percent of males, and of coitus with 12.53 percent. With the lowest educational group, coitus provides the first ejaculation with 18.5 percent of boys.

THE MOST active period of sex activity is in late adolescence. (Note how out of step this is with what are presumed to be our social mores). "For the mass of the unmarried boys, intercourse still provides the chief sexual activity." Masturbation is more prevalent among the better educated portions of the population, but is taboo among the lowest educational level. This means that the majority of the males in the sexually most potential and most active period of their lives have to accept "clandestine or illegal outlet or become involved in psychological conflicts in attempting to adjust to reduced outlets."

The average adolescent girl gets along with a fifth as much activity and the frequency of outlet of the female in her twenties and her early thirties is below that of the average adolescent male. Kinsey here pointedly alludes to the fact that the woman is usually the one, as parent or teacher or social worker, who plays an important part in setting the moral standard for youth. Eighty-five percent of the younger male population is eligible for conviction as sex offenders if our laws were to be strictly enforced.

The evidence disproves a familiar warning against wasting one's virility by early sexual experience. As a matter of fact, boys who mature early, turn more often to masturbation and to homosexual and to heterosexual activity; and it appears that these are in general, more alert, energetic, physically active, extrovert and aggressive.

"For the boys who have not been too disturbed psychically, masturbation has, however, provided a regular sexual outlet which has alleviated nervous tension; and the record is clear on many cases that these boys have on the whole lived more balanced lives than the boys who have been more restrained in their sexual activities."

Heterosexual petting to the point of climax

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Audio-Visual Aids

EDITED BY CHARLES R. CRAKES

The editor of this department will attempt to bring before the readers of this publication the latest articles written by science teachers who are making effective use of various forms of audio-visual teaching materials. He will also endeavor to present a cross-section of educational opinions on audio-visual aids he may gather in travelling about North America.

Miss Margaret Albrecht's article entitled "Audio-Visual Materials in the Elementary Science Program" is most timely. As your editor travels about the nation he is receiving an ever increasing number of inquiries about the place of audio-visual materials in an efficient elementary science program.

Miss Albrecht suggests some very clear cut reasons why we must place more emphasis on the general field of science, particularly in the early grades. Her suggested list of films will, of course, be supplemented by many more excellent films which are coming from producers.

Upon inquiry your editor will be most pleased to send you lists of projected teaching materials suitable for elementary grades.

Miss Albrecht has for many years been connected with the public schools in Moline, Illinois. For a number of years she has served as principal of the Irving school of that city. She holds a Master's Degree from Northwestern University, Evanston, Illinois.

During her many years of experience in the elementary field she has been particularly interested in bringing about a closer relationship between the activities carried on within the classroom and the outside world in which her girls and boys live.—C. R. Crakes.

Audio Visual Materials in Elementary Science

MARGARET ALBRECHT

Principal, Irving School
Moline, Illinois

BOYS and girls of today are living in the atomic, or possibly more realistically, in the post-atomic age. This is the era of the "Truculent Turtle" and the "Pacusan Dreamboat." We are told that transpolar war has proven to be quite possible, that the atomic bomb has been supplemented by more effective modes of destruction, that our natural resources which a few generations ago seemed boundless, are dwindling dangerously fast. All of which adds up to the fact that our present day children are growing into a challenging age, one which will tax their resources to the utmost.

To meet this challenge, our children will need to be equipped with all the tools we are able to provide, factual information, appreciations, attitudes, ability to think clearly, to make wise decisions, and so on endlessly.

THE INITIAL objective of an elementary science program would be that of acquainting little children with, and helping them to understand, their dependence upon their immediate environment. This can and should be a most interesting experience, for the wonders of a natural world fascinate young and old alike. "Why is this flower red? Why do leaves change their color? Why do squirrels bury nuts?" These are but a very few instances of the countless questions directed at the teacher of small children.

The desire for an answer is a potent force and provides a wonderful opportunity for the interested teacher to learn with the children. The resources in this area are practically limitless, for some observing eye will have a contribution to make daily.

ASIDE from gaining factual information, what can a well-planned science program do for our children? It would help them to discriminate judiciously, to think critically. Every scientific conclusion must be based upon facts. This will necessitate a democratic

exchange of opinions and analysis so that only the essential factor will be retained. Evidence must be carefully sought, thoroughly weighed and judgment suspended until a conclusion has definitely been found to be valid. This type of thinking will be indispensable in a social order in which various forces resort to such means as propaganda and high pressure. It should also prove a strong line of defense against superstition and outworn tradition.

Teaching aids on the market are becoming increasingly varied and helpful. We are cognizant of the fact that for little children direct experiences serve as a satisfactory medium, but as children mature, they gradually become interested in a world somewhat removed from their immediate environment. Consequently, we find it necessary to supplement the child's information through vicarious experiences.

Here particularly, we find a most effective teaching medium in our various visual and audio-visual aids. Children are bound to be equipped with varying and frequently limited, background. While the teacher will do her utmost to plan worthwhile excursions, many schools are located in areas that offer little help in giving us the help we need.

FOR LITTLE children with scant backgrounds, sound motion picture films provide an exceptional opportunity to grasp new relationships. Films describing the life of our woodland friends, for instance, are always viewed with interest and delight by our little children. Such films as *Fluffy, the Kitten, Gray Squirrel, Bunny Rabbit, Grey Owl's Little Brother, Three Little Bruins in the Woods*, and *Adopting a Bear Cub* are but a few among those from which we may choose. Nor are our feathered friends neglected, and fortunately so. We find ourselves able to choose from a complete selection of sound and colored films, which will serve to create a rich background of experiences.

For groups interested in other forms of life about us, we find films on ants, honeybees, butterflies and moths. The potential fisherman may find his curiosity satisfied upon viewing some of the films on life in the water. Such titles as *People of the Ponds, Down at Our Pond*, and *Dweller of the Deep* suffice to give us a suggestion.

Particularly revealing for children in urban communities, is information on plant life. Let's look at *Trees, From Flower to Fruit, Autumn Leaves, When Winter Comes* as among those from which we may draw.

A group of kindergarten children had been watching a squirrel from their schoolroom window during the autumn months. After some observation they were shown the film *Gray Squirrel*. Their delight at the antics of Gray Squirrel was amazing, in view of the fact that most of them attend movies frequently. They had learned that their little friend must have food. Fortunately, a friend of little children who lived reasonably near, permitted them to come into her yard and gather walnuts. Each day some nuts were placed at the base of a large tree, and each play period the heap of nuts was guarded, lest some imposter cheat our squirrel. Later the film was re-shown.

ANOTHER worth-while outgrowth of this experience exhibited itself in the interest in birds. After the Christmas holidays, a tree was erected for birds. Food was brought each day, and these little folks were hopeful that their teacher will some day show them such a film.

In an ungraded room, a rabbit occupied the center of attention. Charts and pictures were made and used in the room. These children had the opportunity to see the film, *Bunny Rabbit*. An opaque projector might have been of great value. However, school systems are not always as completely equipped as we should like.

Happily, our opportunities for broadening the child's background do not end here. Let us add film strips and slides. As the cost of photography becomes less prohibitive, we will be enabled to make many of our own helps. These will never completely replace those aids prepared by specialists, but they will have a definite place in our program.

We must bear in mind that these various visual aids serve as supplements to our teaching. Used judiciously, they will serve not and the questions asked, it was quite evident that the children had gained worth-while experiences.

CHILDREN'S GARDENS

Continued from Page 21

buying, organized by the teacher or leader. Low costs mean many gardens.

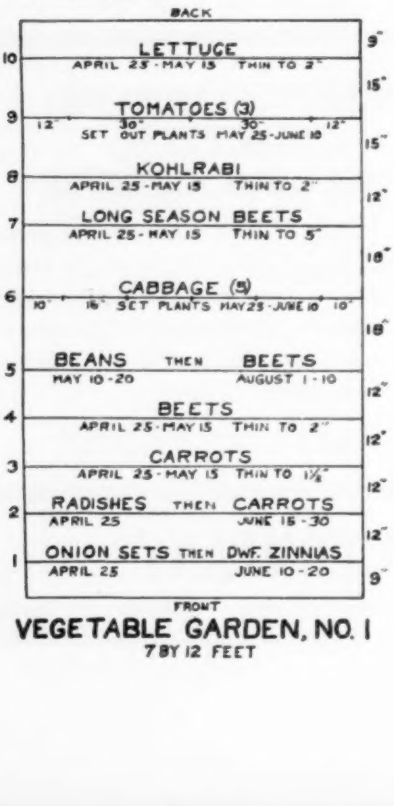
Sample Plans

THE accompanying plans are for gardens which have been grown with marked success in the Mid-West, by thousands of children. They are for youngsters 10 to 12 years old, although younger and older may find them of value. For a larger garden, the 8 by 16 plan may be doubled, to make a plot 16 feet square. That is a satisfactory size for children working on a school garden tract.

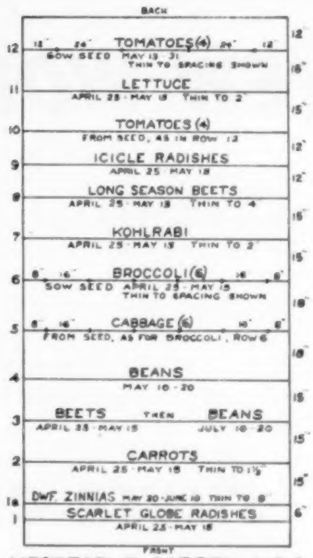
The garden carried on by a boy or girl in conjunction with other children on a school-directed tract, may be larger than a home garden without violating the first principle, of small size. The youngster working alone has a much shorter span of interest in the job than he has when working with his friends on a multiple-plot garden. Consequently the plots may be larger in such instances.

These are primarily vegetable gardens and boys and girls growing them may feel that they are doing their part in the national FREEDOM GARDEN MOVEMENT.

A plan successfully grown by pupils in grades four, five, and six.



VEGETABLE GARDEN, NO. 1
7 BY 12 FEET



VEGETABLE GARDEN, NO. 3
8 BY 16 FEET

A good junior high vegetable garden plan.

SCIENCE IN GENERAL EDUCATION

Continued from Page 18

method, (3) a knowledge of the fundamental principles of the science, (4) an understanding of natural phenomena, (5) a realization of the social aspects of current applicatons of science. The discussion points out that these aspects of science are essential in attaining the goals of general education.

A Chemist Looks at Science Education

DR. C. H. SORUM

Department of Chemistry
University of Wisconsin

Abstract

College and university teachers in the elementary science courses are faced with the problem of teaching an ever-increasing amount of material in a restricted amount of time. The students to whom these sciences are taught are too often not well prepared to undertake college work. Elementary science textbooks are, in general, too comprehensive

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DEMONSTRATING PHYSICS

Continued from Page 23

time that neither the weight or the hammer was changed in speed very much.

Moral: "Use strong contrasts to make principles emphatic." A modest pull on the thread produces in 3 seconds more change in the momentum of the big weight than a sudden pull of more than 160 pounds lasting for a small fraction of a second. Also, in this case the "weight" of the iron is supported by the table and the experiment emphasizes inertial properties independent of weight.

FIFTH, I have here two simple rolling carts made from 3-foot planks, each with a pair of old roller skates for bearings. They can be used for a variety of experiments on action and reaction to teach the laws of motion. I shall show you only two or three.

If I stand on the floor and make a standing broad jump, I move several feet forward. I pushed the earth backward, but the earth "can take it." But if I stand on one of these carts and jump, you see that I advance only a few inches while the cart is shot backward with great speed against the wall. I had nothing massive to push against. But if Mr. Tapley now squats on the same cart and takes a good hold, then when I jump forward, I send him coasting across the room while I give myself enough forward speed to make a reasonably good jump. Here you see action and reaction in operation. Equal forces act for equal lengths of time to propel me forward while Mr. Tapley goes in the opposite direction. If our masses were the same, our initial velocities would be equal and opposite. In any case, the momentum that I acquire is equal and opposite to the momentum given to Mr. Tapley and the cart.

Now let us try two carts instead of one. This time, Mr. Tapley and I stand on different carts. Our bodies are connected by two ordinary screen-door springs. If we push against one another, we fly apart but the springs soon stop us and pull us back together. Notice that the carts meet again right where they started, as shown by this "zero

mile post" (an ordinary laboratory stand). Our common center of mass did not move from that spot throughout the motion.

Moral: "Use large scale experiments. The impact of an experiment on the student's mind is proportional to the solid angle subtended by the apparatus." The laws of physics as applied to the action of the human body give life to problems that ordinarily talk only about "particles", "masses", and "objects".

NEXT, jet propulsion and the present interest in rockets is the chief example of the action-reaction principle in the minds of most students today. During the war, the "bazooka" made front page news, and more recently the V-2 rocket research has excited interest. Back in 1943, it occurred to me to use small cartridges of carbon dioxide to propel a home-made "baby bazooka." These cartridges weigh about 32 grams and can expel one-fourth of their weight when the seal is broken. Those 8 grams of carbon dioxide expelled in one direction can give considerable velocity to the cartridge and associated tail piece. At the risk of damaging the hotel, I shall now shoot one of these rockets by driving a firing pin into the seal. The projectile is held in a metal aiming tube, open at both ends. The firing pin is a phonograph needle in the end of a rod. When struck by a hammer, there is a Pssst, and away goes the rocket! I have shot these projectiles 75 yards in the open. More recently, this same device has been used to propel small rocket automobiles that ride a steel wire at 60 or more m.p.h.

Moral: "Create modern illustrations of old principles." Use modern materials. Take advantage of student interest. You may want to argue with your students whether or not a rocket like this would operate in a vacuum. Time is too short to argue with you about it now.

(Concluded in April issue)

Write for It

Talks is a quarterly digest of addresses presented in the public interest by the Columbia radio network. For Vol. 13, No. 1, Jan. 1948, write to the Columbia Broadcasting System, Inc., 485 Madison Avenue, New York 22.

SEXUAL BEHAVIOR

Continued from Page 32

is most prevalent among the higher level group, but practically taboo with the low level group. It occurs among 32 percent of high school boys, and 61 percent of college bred males, who are not married, by the age of 30. Petting appears to be a result of the upper level's attempt to avoid pre-marital intercourse.

THERE IS NO evidence that premarital intercourse has increased over previous generations; the petting has. Sex questions asked by youth (College level?-Ed.) are often concerned with physical effects of petting. Evidence appears to indicate that premarital petting contributes to sexual adjustment in later married life.

Investigators of High Repute

Dr. Alfred C. Kinsey is Professor of Zoology at the University of Indiana. He is well known for many published papers and books. His principle research associates are Clinical Psychologist Wardell B. Pomeroy and Statistician Clyde E. Martin.

Dr. Kinsey's ability to gain the confidence of the people in all walks of life, and his expertness in the art of interviewing is almost miraculous. He is helped by a corps of well trained assistants. The records are strictly confidential, consisting of the application of a complex code system. Data is sorted and organized with punched cards on an automatic business machine. The study, still in progress, has been receiving considerable support by the National Research Council Committee for Research on Problems of Sex and financial support from the Medical Division of the Rockefeller Foundation.

THE FIRST four chapters provide fascinating reading for those interested in this type of research. They explain the historical development of the work, the technique of interviewing, statistical problems and a careful analysis and discussion of the validity of the data. A new technique was developed for calculating accumulative incidence curves. 26 percent of

the 12,000 histories now at hand have come from 100 percent groups, the remainder from unselected individuals in whole groups. Dr. Kinsey considers his data as a fair approximation. In each case, 521 items are explored.

A major proportion of the test is concerned with incidence figures and average frequency of experiences for groups representing whole portions of the population.

Kinsey avoids the pitfalls common to previous publications which were colored by moral values and philosophic theory; and which presumed to develop broad generalizations and to prescribe social procedures which the limited data did not warrant. There has been no previous study resulting in such a mass of data, nor with data so carefully and thoroughly gathered.

That this investigation and publication of its findings continues to enjoy the full support of the University of Indiana, the National Research Council, and the Rockefeller Foundation, notwithstanding emotionalized opposition, stands as a tribute to these institutions and affirms the recognized ability of its principal investigator.

CHATS WITH SCIENCE TEACHERS

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are some for autumn, for winter, for spring, for summer; for cloudy and sunshiny days; for rainy and dry weather; for snowstorms and thunderstorms. There is humor, usually subtle, as

> . . . All human history attests
> That happiness for man—the hungry sinner!—
> Since Eve ate apples, much depends on dinner.
> —*Lord Byron* (1788-1824) of England.

There are tragic verses, too, though they should be used with discretion.

SHALL these daily verses be "interpreted"—their meanings discussed with prosaic explanations? This may not be best, as a rule. It will be like tearing to pieces the flowers of a beautiful bouquet brought to the teacher's desk. The young folks probably have more insight into poetry than you credit to them.

Another way to use poetry in the science classroom is to find complete poems about nature, and assign them as recitations to competent—and cheerful—students. These as a rule are not too lengthy for this memory

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THIS AND THAT

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Chicago A.A.A.S. Meeting

It was a real pleasure to be able to greet so many of you at our Christmas-time meeting in connection with the A.A.A.S. One of the fine parts of meetings is the renewing of acquaintances not to mention the value gained in the exchange of ideas, etc.

Many of the fine papers presented there will appear in these pages as space permits. It was another excellent meeting.

Summer Meeting-Cleveland

N.E.A. has set aside Monday, July 5th as the day for meetings of its Departments. As usual N.S.T.A. will have a morning and afternoon program. Judging by reports received from Mr. A. O. Baker, Chairman, the Cleveland group is planning a very attractive program. More on this later, however.

Due to the hotel situation, this will again be a limited meeting. By this is meant only delegates of the N.E.A. Representative Assembly can be accommodated at the Cleveland Hotels.

Each State, district and local association of the N.E.A. is pro-rated a certain number of delegates to the N.E.A. Representative Assembly according to its membership. Contact your local, district or state association officers now, relative to an appointment as a delegate. Then come a day earlier for our N.S.T.A. meetings.

You are cordially invited to our Cleveland Meeting. We hope as many of you as can, will be present.

Student Teacher Membership

The Board of Directors at the Chicago meeting, voted a $1.00 membership to undergraduates in colleges or university who are planning to enter the teaching profession. Be sure to make clear that you are entitled to such a membership, so that you will not be requested to send the additional $1. Dues are normally $2.00.

INDUSTRIAL CONFERENCE

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be established. Unless this is achieved, science teaching cannot receive the help which it needs badly, and industry will find in the schools not sales resistance but hostility."

Dr. Meister told of the interest of the National Science Teachers Association in the entire problem, and its activities in the development of a service for the membership which includes the selection, evaluation and distribution of useful and timely "Science Information for Teachers". "To date," Dr. Meister said, "thirty different pieces of such literature grouped in packets have been mailed to more than 5,000 science teachers throughout the country."

THE enthusiastic response of the three hundred members of industry and science teachers present was reflected in the discussion following the formal program of the afternoon. Throughout the discussion it was emphasized that the two groups should co-operate in the understanding of the problems of the science teachers, and in the planning of an educational program that will serve the needs of science teachers. Several items of interest brought up for consideration by the group included:

1. General format of materials in terms of the needs of the classroom teachers.
2. Extent of educational information to be covered in any one item of educational material produced by industry.
3. Production of materials for elementary as well as secondary science teachers, and for teachers in other fields of education.
4. Instruction on the use of teaching aids in the classroom.
5. The development of a suitable clearing house for helping industry to plan educational materials.

AS A RESULT of the conference a motion was made and unanimously carried to

authorize the formation of an Advisory Council on Industry-Science Teaching Relations, for the purpose of formulating recommendations as to:

1. Desirable industrial-educational programs, in which industry and science teachers can cooperate effectively; such as essay contests, prize awards, scholarships, grants, commercial literature, charts, exhibits, models, film strips, films, etc.
2. The development of a method of providing specific help to industries interested in sponsoring educational programs and producing aids to science teaching, and to schools interested in using such programs and aids.
3. The development of ways of measuring the effectiveness of industrial-educational programs for industry and for schools.
4. The further development of standards and procedures for evaluating the educational usefulness of such programs and aids to science teaching.
5. The further development of methods for the effective distribution and use of aids to science teaching which meet high standards of excellence.
6. Desirable and adequate means of financing the services indicated above.

SCIENCE IN GENERAL EDUCATION

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and not ideally arranged for good teaching.

The solution to the above problem may possibly lie in (1) increasing the number of years of high school and college schooling, (2) increasing the number of credits and hours for elementary science courses, (3) establishing closer coordination and cooperation between high school and college teaching, (4) developing a broad program of science instruction running from the first grade through high school and college, (5) maintaining high standards of attainment, (6) setting up uniform courses of high school science study, (7) insisting that textbooks be written for the student and that these textbooks be designed for good teaching and good learning and not for reference.

The heart of all good teaching will always be good teachers.

BOOK SHELF

ELEMENTS OF RADIO SERVICING. William Marcus, co-author of "Elements of Radio," and Alex Levy, Instructor in Radio Mechanics, Manhattan Trade Center for Veterans and Chelsea Vocational High School. McGraw-Hill Book Co., New York, 1947. 475 pp. $3.60.

The book is based on a typical superheterodyne AM receiver. By including common variations in different units of the set, a chapter on the AC/DC power supply and two chapters on the auto radio, the basic principles of most receivers now in use are covered from a servicing point of view. The standard circuit is broken down in a practical way, and testing procedure is clearly outlined. A short chapter on the multimeter and three short chapters on the signal generator, explaining its function, setting up and application, are included. The text is appropriate for use by vocational school students who already have an elementary knowledge of radio theory.—J. S.

ENERGY UNLIMITED. Harry M. Davis, Science Editor of Newsweek. Murray Hill Books, New York, 1947. 273 pp. $4.00.

For minds preoccupied with the destructive possibilities of science in a possible future war, this book should supply a pleasant antidote. It is a popular exposition of the fruits of the modern science and technological laboratories, from the high frequency machine that speeds the cooking of hamburgers to the high voltage machine that smashes the very core of the atom. Mr. Davis combines a profound understanding of the work of the scientist with his rare ability to fascinate the popular reader. Included in the book are stories on the scientists, electronics, radar, electronic navigation, television, atomics, sources of energy, and the changing concept of the universe.—J.S.

ELECTRICITY, PRINCIPLES, PRACTICE, EXPERIMENTS. Charles S. Siskind, Assistant Professor of Electrical Engineerin , Purdue University. McGraw-Hill Book Co., New York, 1947. 448 pp. $2.60.

An elementary presentation of general principles of AC and DC electric circuits, devices and machines. Considerable attention is given to measurements in both DC and AC circuits. Numerous demonstration experiments are outlined and construction projects are explained. Among these is the design and construction of an E-type electromagnet which is used in other parts of the text for experiments on electromagnetism and transformers. Each of the eight chapters is concluded with a summary, a list of questions and problems. The appendix contains a list of visual aids applicable to each chapter and brief notes on great men in electrical science.—J. S.

OLD WORLD LANDS. Harlan H. Barrows, University of Chicago; Edith Putnal Parker, University of Chicago; and Clarence Woodrow Sorensen, University of Minnesota. Silver Burdett Company, New York and Chicago, 1947. 346 pp. 20x26½ cm. 264 illus. $2.88.

Old World Lands, the third in a series of elementary texts in geography, is designed for the sixth grade and follows *Our Big World* and *Man and His World* for the fourth and fifth grades.

The authors have shown the ability both through the use of pictures and a discussion of people, their habits and problems, to make life in foreign lands very real. The emphasis is upon man and the earth as the home of man.

The book being written since World War II presents realistically conditions as they now are. Russia, for example, is presented as the Russia of today with newly acquired territory and increased resources. Not only are the problems of people in many areas indicated, but problems that concern us all, such as uneven distribution of world resources, adjustment of world trade, and the development of atomic energy, are considered together with their implications and possible solutions.

The material is based on field studies of the authors, at least one of which has been in each of the countries concerned. The book is well illustrated with meaningful pictures which add greatly to understanding of life. Eighty-one of them are in color. All maps are large and clear and many of them are in color. A teacher's guide and workbook to accompany will be ready soon.

BASIC UNITS IN PHYSICS. Frank E. Stewart, Brooklyn Technical High School, New York City. Edited by Raymond Agren, Northeastern High School, Detroit, Michigan; and Michael N. Idelson, Abraham Lincoln High School, New York. Republic Book Company, Inc., New York, 1947. 380 pp. 12x19 cm. 262 illus. Paper binding. $.75.

Basic Units in Physics is a concise high school text that will appeal to many students because of its convenience. The book is complete in the units included and also up-to-date. New topics include jet propulsion, atomic energy and atomic fission, cyclotron, Geiger counter, television, electron tubes, fluorescent light, radar, etc.

The book is outstanding in the use of color in making diagrams stand out and easier to understand. Many experiments and demonstrations are described and supplement class demonstrations and laboratory work. Ample problems are included at the end of each chapter to give practice in all types of exercises.

FUNDAMENTAL ACTIVITIES IN BIOLOGY. Edwin L. Harer and Chelsey G. Remley, Upper Darby High School, Upper Darby, Pennsylvania. Republic Book Company, Inc., New York, 1947. 302 pp. 17.5x25.5 cm. illus. $.90.

Fundamental Activities in Biology is a combination workbook and laboratory manual for the high school. It consists of nine units with the broad topics subdivided into parts, permitting the teacher to use the material in any special order he prefers. Each unit begins with an illustrated preview to arouse interest and introduces the student to the work. Each closes with a review outline.

The approach is both morphological and functional. Not only are structures studied as such but their functions are emphasized. The book contains many drawings and diagrams that help make the topics clear. Page references are given to twenty textbooks.

SCIENTISTS STARRED. Stephen Sargent Visher, Indiana University. The Johns Hopkins Press, Baltimore, Maryland, 1947. 556 pp. 15x22.5 cm. 117 illus. $4.50.

Scientists Starred (1903-1943 in "American Men of Science") concerns 2,607 scientists who have been voted by their peers as especially outstanding. The book tells who are listed and why. Further, it presents a study of the collegiate and doctoral training, birthplace, distribution, backgrounds, and developmental influences.

The finalchapter presents some backgrounds and judgments deduced from a questionnaire to starred scientists. It considers influences contributing to achievement and also the attributes considered especially significant for outstanding success in scientific work. Suggestions are also made as to desirable training and conduct.

GOVERNMENT PUBLICATIONS

McKee, Roland, SUMMER CROPS FOR GREEN MANURE AND SOIL IMPROVEMENT. Farmers' Bulletin No. 1750, USDA. 16 pages, 1947.

This bulletin discusses the crops commonly used and how such crops may be used most effectively in a soil improvement program. Problems such as inoculation, use of fertilizer, treatment of seed, and seeding are discussed. The various crops suitable for green manure are discussed, including the value of weeds for soil improvement. This bulletin will meet a need in the study of conservation in secondary schools.

Mulford, Furman L., ROSES FOR THE HOME. Farmers' Bulletin No. 750, USDA. 34 pages, revised, 1932.

This bulletin discusses general culture, kinds of roses and the locations and conditions suitable for their growth, care of roses, including instructions for pruning, protection, spray and cultivation. While newer varieties are not discussed and new sprays are not included, yet the basic information about rose propagation and care is still useful.

Oman, P. W. and Cushman, Arthur D., COLLECTION AND PRESERVATION OF INSECTS. Miscellaneous Publication No. 601, USDA. 42 pages, 1946. Superintendent of Documents, 15 cents.

This publication gives information on collecting, preserving, handling, mounting, and labeling insect specimens, on subsequent care of collections, and on recognition of the general insect groups, or orders. Suggestions concerning how to make some equipment are given together with comments about rearing insects. The bulletin would be useful to teachers at elementary school levels and to both teachers and pupils in secondary schools.

TEACHING SCIENCE

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be learned from science, our science teachers are silenced.

I have tried to indicate some of the ways in which science teaching at all levels is essentially the same. At each level in the individual will be acquiring a greater fund of factual knowledge and higher technical ability. But our prime aim is to increase, at every level, the individual's independence of judgment and competence in reasoning so that he can be a better human being able to make his contribution to historical progress.

SOLAR SYSTEM

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In the model the planets are arranged along a radial line from the sun; of course this alignment actually occurs very rarely for the periods in which the planets move about the sun become increasingly great as the distance from the sun increases. In fact Kepler's third law relating the mean solar distance and period can be found from the tabulated data. If the mean distance is a and the period is P, $a^3 = P^2$ as can be found most readily by plotting log a against log P.

Construction of such a model is almost certain to elicit numerous questions about how these distances were determined and what the physical conditions on the other planets are. While many good books cover the general aspects of astronomy, three of the recent Harvard Books on Astronomy deal in some detail with information about the solar system and how that information was obtained.*

FROM A consideration of the vastness of the solar system, itself a mere grain of sand in the universe, the discussion may develop into an analysis of the scientific method by which it is possible for human beings—insignificant microbes on the head of a pin (in the model)—to plumb into the vast reaches of space and obtain relatively precise information on the number, spatial distribution, motion, chemical composition, temperature, and physical state of planets, comets, stars, nebulae, and galaxies.

*Fred L. Whipple, *Earth, Moon, and Planets;* Fletcher G. Watson, *Between the Planets;* Donald H. Menzel, *Our Sun* (in press), Blakiston Co., Philadelphia.

News and Announcements

Coming Meetings

The NARST is meeting in Atlantic City, February 21 to February 26. Dr. Ira Davis of the University of Wisconsin is in charge of the program.

The Illinois Association of Chemistry Teachers will hold its spring meeting at Ottawa, Illinois, the week end of May 1, according to its president, Mr. Clyde W. Dewalt. Field trips to industrial plants and a live program are planned.

St. Louis Activities

The advancement of science education in the Greater St. Louis Area will be greatly aided by two coming major events. One is the Science Fair to be held March 29-April 1; the other is a Laboratory Shop for Science Teachers (elementary and secondary) to be held during the coming summer at Washington University. Those interested should get in touch with Miss Ernestine M. J .Long, 1618 Quendo Avenue, St. Louis 14.

Award in Analytical Chemistry

An award of $1,000 for *Outstanding Achievement in Analytical Chemistry* is being offered by C. G. Fisher, president of the Fisher Scientific Company and of Eimer and Amend. It is to be administered by the Board of Directors of the American Chemical Society. The first award is to be made at the annual fall meeting of the American Chemical Society in September, 1948.

President Fisher, himself, was presented a placque December 18 by the Pittsburgh section of the A.C.S. in recognition of the contributions he has made to chemical progress over a 45-year period.

Fellowships for Physics Teachers

The Case Institute of Technology is again offering fifty General Electric Fellowships for High School Teachers of Physics for a six-weeks program of study during the summer of 1948 with expenses paid. Teachers of physics from the following states are eligible to apply: Ohio, Michigan, Western Pennsylvania, West Virginia, Kentucky, Indiana, Illinois, and Wisconsin. The program is designed to acquaint teachers with recent developments and research in physics. Application blanks may be obtained from Dr. Elmer Hutchisson, Dean, Case Institute of Technology, Cleveland.

Write for It

Sugar is a 40-page booklet beautifully illustrated, telling of the production and processing of this natural food and useful chemical. The booklet is distributed by the Sugar Research Foundation, Inc., 52 Wall Street, New York 5.

CHATS WITH SCIENCE TEACHERS

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achievement. A search of longer poems will also bring many fine passages to your list. The *Essay on Man* by Alexander Pope (1688-1744) of England is full of keen comments on humans and their surroundings. The poems of Henry Wadsworth Longfellow (1807-1882), James Russell Lowell (1819-1891), Henry David Thoreau (1817-1862), and Walt Whitman (1815-1892) and many other Americans abound in vivid descriptions—in fact, if they had not been naturalists they could not have been poets!

SHALL ONLY the verses of *established* poets be used for the daily blackboard lines and the recitations? By no means! Many teachers seem not to have discovered that their classes are full of young poets, who will write surprisingly well if given encouragement! For many years, as editor of *Current Science*, I published an annual Spring Poem Issue in which the best of more than a thousand original verses of youthful readers were used each year. Your class surely contains poets! Let them try their skill. Put their products on display. Even try *your own* talents for "the best words, in their best order."

O sober science teacher! Have you heard
That songs as well as eggs come from a bird?
And do you know—in your instructive hour—
That scents as well as seeds grow in a flower?
Let prose and poetry be well combined,
And give to science heart as well as mind.
—*Ernest Rhymer* (1888-) of the United States.